The present invention provides a system for process control in a combustion application, comprising a tunable diode laser for generating a frequency modulated near-infrared laser beam, a transmitting means for transmitting the near-infrared laser beam through off-gas produced by the combustion application, a detecting means for detecting the transmitted laser beam, a controller means for analyzing the detected laser beam for select CO and H_2O absorption lines to determine CO concentration, and for producing an electrical signal in response to CO concentration, and a control system for providing adjustment of select inputs to the combustion application in response to the electrical signal from the controller means.

In the invention disclosed, the controller comprises means for providing predetermined calibration curves to determine CO concentration. In particular, the calibration curve is CO concentration as a function of CO absorption lines and temperature. For the embodiment disclosed, the controller determines the temperature of the off-gas from analysis of the H_2O absorption lines, and particularly H_2O absorption lines that respond differentially to changes in temperature. In the preferred embodiment disclosed the temperature of the off-gas is determined from the ratio of two H_2O absorption lines. The CO absorption lines are chosen where they have a profile of strong lines as compared to H_2O.

Please replace the paragraphs spanning page 4, line 28, to page 5, line 10, with the following rewritten paragraphs:

This invention also provides for a method of process control in a combustion application, comprising:

a) transmitting a frequency modulated near-infrared laser beam through off-gas produced by the combustion application to target CO and H_2O;

b) detecting the transmitted laser beam; and

c) analyzing the detected laser beam for select CO and H_2O abs rption lin s;

d) determining CO concentration from the CO and H_2O absorption lines;

e) adjusting select inputs of the combustion application in response to the CO concentration.

In the method disclosed the CO concentration is determined using predetermined calibration curves. In particular, the calibration curve is CO concentration as a function of CO absorption lines and temperature. For the embodiment disclosed, the method targets H_2O absorption lines to determine the temperature of the off-gas, and particularly H_2O absorption lines that respond differentially to changes in temperature. In the preferred embodiment disclosed the temperature of the off-gas is determined from the ratio of two H_2O absorption lines. Moreover, the method of a preferred embodiment of this invention targets CO as one off-gas for analysis, and particularly where CO has a profile of strong lines compared to H20. While temperature measurements are necessary from a spectroscopic point of view, they are also valuable from other perspectives, including process control, quantification of exhaust gas thermal energy, improved air pollution control system design and operation, and others.

Please replace the paragraph beginning at page 14, line 17, with the following rewritten paragraph:

A3

Using a 90/10 beam splitter 56, approximately 10% of the laser beam 58 is passed to reference cell 54 to lock the laser onto the selected absorption feature. For room temperature measurements (approximately 0–50°C) reference cell 54 at atmospheric pressure (approximately, 100 kPa) can also serve as a secondary calibration standard. For high temperature applications, however, as, for example, found in the exhaust duct of an EAF, the calibrations found in reference cell 54 for the targeted species are inadequate. High temperature applications require calibration curves to be

calculated and stored, for example, in computer 52. The remaining 90% of the beam is used for the measurement channel.

Please replace the paragraph beginning at page 20, line 14, with the following rewritten paragraph:

A4

Since the magnitude of the modulated signal of the gas detected at 2f is proportional to the laser return power, it is important that the power be continuously monitored. The power varies from time to time due to the dust loading and the debris that crosses the laser beam. Also, the background radiation level from the arc in an electric arc furnace can be significant. A part of the background radiation from the arc that falls on the detector bandwidth is easily detected as well, along with the 'true' laser return power. This background radiation is monitored and subtracted to obtain the true power to compensate for the changing magnitude of the measured signal due to dust, debris and optical misalignment. In the current configuration, the laser current is switched "OFF" as at 71 for a very short period of time at the end of each integration cycle. The background radiation that is seen by the detector is measured during this period. The laser is then switched "ON" and the scan continues.

Please replace the paragraph beginning at page 30, line 12, with the following rewritten paragraph:

A5

A schematic of an EAF system using the process sensor of this application is shown in Figure 15. A more detailed view of the exhaust duct is shown in Figure 16. In general Figure 15 shows an EAF 10 having an exhaust duct 20. A laser source 26 is provided to transmit a laser beam through fibre optic cable 28 to a launcher assembly

30 (see Figure 16). The laser beam is transmitted across duct 20 as at 60 to detector 32 which, in turn, transmits an appropriate electronic signal back to source 26 via a coaxial cable 34. It can be appreciated that a fiber optic cable can also be used in place of coaxial cable 34. Source 26, through use of a computer that can be located on-board (for example, see Figure 4) uses the calibration curves calculated for high temperature applications to interpret the readings of the concentration of, for example, CO, from detector 32 and sends an appropriate signal to an EAF process control system 62. Control system 62 can then adjust the oxygen flow through controller 64, or temperature of the EAF through, for example, natural gas flow controller 66, as needed. Figure 15 illustrates a process control system that uses real time sensors to obtain selective measurements of the off-gas constituents and provides adjustment of the inputs to a furnace (such as oxygen, fuel, electric power, etc.) on a continuous feedback loop.

<u>In the drawings:</u>

The Applicant has amended Figure 3 to add launch assembly 30 as discussed in the specification, page 13, lines 22–26.

Further, applicant provides a revised Figure 4 adding the reference characters mentioned in the middle two paragraphs of page 14 of the specification.

Formal figures for all of the drawings will follow.

<u>In the claims:</u>

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